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water passed through a Pasteur-Chamberland filter, they will remain colorless; if kept in such filtered water to which a loopful of a pure culture of the alga has been added, they will turn green as completely as if they were kept in unfiltered sea-water. Apparently the young animals cannot be infected by cells removed from the bodies of older green Convolutas.

The green cells are reported to undergo degeneration in the tissues of the animal, especially as regards their nuclei, and to this is attributed the inability of the green cells to maintain an independent existence, or to thrive in cultures, or to infect young Convolutas, when removed from the bodies of older green ones. Whether under suitable conditions of culture, the algal cells may be able to complete themselves, to restore or to regenerate the deficient nucleus, to become rejuvenated, is not determined by these experiments.

The functions of the alga in the body of its host have been experimentally studied. The authors conclude that the alga, photosynthesizing sugar, is osmotically relieved of a considerable portion of this food. It must diffuse, if it remain unchanged, to adjacent cells containing less; but if the sugar be converted into starch,the animal cannot digest and absorb it so long as the algal cells themselves live. Soon after infection with the alga, the animal ceases to excrete its nitrogenous wastes, and these, absorbed by the alga, are converted by it into higher organic compounds, into nitrogenous foods. As many of these as are soluble also diffuse into adjacent animal cells. At this stage it would appear that both animal and plant profit by their association, the animal gaining a supply of sugar and of soluble nitrogenous food, the plant obtaining a steady supply of partly elaborated organic nitrogenous food-material. Later on, however, the animal ceases to ingest solid food, and there being no other source of nitrogenous food than the algal cells themselves, the animal proceeds to devour them in its own tissue. Thus it destroys its source of food and ultimately itself, but before this it breeds.

This association, therefore, is similar to that of fungus and alga in lichens, where the fungus component, incapable of photosynthesis, is forced to obtain non-nitrogenous food, saprophytically or parasitically. The excreta of the dependent component may manure the green plants, but if they do, the benefit is a dubious one, since it leads to destruction without issue.

A word may well be added to commend the ingenuity of the experiments, the care and thoroughness with which they seem to have been carried out, and the caution with which inferences have been drawn from them and stated.—G. J. PEIRCE.

Plant diseases.—A root disease of sugar cane, first described from Java in 1895 by WAKKER is the subject of a bulletin by FULTON.[24] It is characterized by canes of reduced size and weight, and by reduced leaf system. A large percentage of affected stalks die. These effects are traceable to deficiency in the root system. The lower leaf sheaths of affected canes do not fall away as they normally do, but remain cemented together by the whitish mycelium of a fungus, *Marasmius plicatus*, which occurs saprophytically upon decaying vegetable matter, and is also able to attack living tissues of low vigor and thus to become a parasite. The conditions favoring attack are summarized as follows: "Slowness of germination and early growth; improper cultural procedures; unsuitable soil; bad drainage; unfavorable seasonal conditions; the stubble crop." Preventive measures are: "careful cultivation; selection and disinfection of seed cane; resistant varieties; destruction of infected trash; resting land from cane."

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[24] FULTON, H. R., The root disease of sugar cane. Bull. 100, La. Agric. Exp. Sta. Jan. 1908.

A second bulletin by the same author treats diseases of pepper and beans.[25] He mentions a wilt of pepper caused by a non-sporing sclerotial fungus; the bean anthracnose due to *Colletotrichum lindemuthianum;* the bacterial blight due to *Pseudomonas Phaseoli;* and a disease caused by Rhizoctonia.

EUSTACE[26] has been experimenting on fruit rots. Tests were made of the ability of fungi to produce decay in cold storage. On March 9 several varieties of apples were inoculated with bitter rot (*Glomerella rufomaculans*), black rot (*Sphaeropsis malorum*), blue mold (*Penicillium glaucum*), brown rot (*Sclerotinia fructigena*), pink rot (*Cephalothecium roseum*), and Alternaria. The fruit was then placed in cold storage at a temperature of 31° F. When removed and examined on May 9, it was found that the only fungus which had caused decay was *Penicillium glaucum.* When removed to warmer temperature, all the other species developed and caused decay. Decay was not entirely prevented by a temperature from 35 to 56° F., and decay proceeded rapidly at a temperature of 48° to 69° F. *Sclerotinia fructigena* on the peach developed decay slightly in two weeks at a temperature of 32° F., when inoculated by puncture. Fruits inoculated by contact merely showed no decay at the end of two weeks under these conditions. Experiments were made to determine whether sulfur fumigation (1 oz. of sulfur to 25 cubic feet of space) would kill the spores of rot producing fungus. It was found that the spores of *Penicillium glaucum* can be killed this way, but that injury is caused to the apples themselves by the sulfur fumes. Careful notes were made concerning the development of apple scab, and it was ascertained that the scab of the apple can increase even when the scab in question is completely covered with a coating of the Bordeaux mixture.

Apple leaf spots have long perplexed the plant pathologist. One of them has at last been definitely proved to be caused by *Sphaeropsis malorum.*[27] The disease in question is characterized by circular or irregular reddish-brown spots with slightly raised purplish margins, which attain a diameter of 3.5 to 13^{mm}. The mature spots are usually circular, but may become irregular. This disease has been variously attributed to Phyllosticta, Coniothyrium, and other causes. The present authors obtained pure cultures of *Sphaeropsis malorum* from all young spots which were studied. From older spots other fungi were obtained. Inoculations with this Sphaeropsis produced typical disease in 5–20 days upon leaves. The fungus causing the leaf spot in nature is probably derived from cankers on the branches which are frequently abundantly infested.—F. L. STEVENS.

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[25] FULTON, H. R., Diseases of pepper and beans. Bull. 101, La. Agric. Exper. Sta. Jan. 1908.

[26] EUSTACE, H. J., Investigations on some fruit diseases. Bull. 297, N. Y. Agric. Exp. Station, Geneva, N. Y. Feb. 1908.

[27] SCOTT, W. M., and RORER, J. B., Apple leaf spot caused by *Sphaeropsis malorum.* U. S. Dept. Agric., Bur. Plant. Ind. Bull. 121, part 5. March 1908.

Peat.—From the Geological Survey of Michigan there has recently appeared a volume on peat.[28] The work consists of three separate essays under the following titles: The ecology of peat formation in Michigan; The formation, character, and distribution of peat bogs in the northern peninsula of Michigan; Economics of peat. The author presents a classification of the Michigan peat deposits based upon (*a*) form of land surface, (*b*) method of development, and (*c*) surface vegetation, in which he seems to follow previous authors. The place taken by plants in peat formation depends directly upon their specific ecological demands, hence the floristic diversity which appears in the formation of peat in shallow depressions, upon flat areas and raised surfaces. Applying this principle, a thorough study is made of Mud Lake, which lies in the southern peninsula, and the successions are well traced out. The conclusion is reached that light is the principal factor controlling the development of peat through its limiting influence on the growth of plants, both below and above the water level. Physical and chemical characters of the substratum, temperature, aeration, mechanical and physiological effects of the wind, and competition are considered cooperating but secondary factors influencing peat development.

In the second essay the northern peninsula is made the basis of study, and the vegetation of a large number of lakes and ponds is described in some detail, and the conclusions reached from the study of the southern peninsula substantiated. A comparison of the conditions found in the two peninsulas leads to the statement that the noted variety of the sedge zone in the north is to be related to the fact "that in the cooler, more humid climate of the north, the shrubs mentioned are able to grow better in the water than they can in the south." From a study of "Algal Lake," a type of peat hitherto unrecognized, in this country at least, must be added to those which were known before, namely, algal peat, formed almost entirely of the remains of one-celled or few-celled plants.

To part I is appended a detail map of the original swamp area of the southern peninsula; while part II is likewise accompanied by a map of the original vegetation of the upper peninsula. These maps should prove of great service, both in this field and as a permanent record of a vegetation too fast suffering destruction.

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[28] DAVIS, C. A., Peat. From the report of the Geological Survey for 1906. pp. 95–395. Lansing. 1907.